

AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph at page 5 lines 9-28 with the following amended paragraph:

While mixing the feed stream and the azeotroping agent, the mixture can be heated to produce a first vapor stream. Alternatively or in addition to heating the mixture, at least one of the feed stream or the azeotroping agent can be heated before they are mixed together. The heating produces a first vapor stream. The heating is sufficient to cause decomposition of at least one the organic acid ammonium salt, the organic acid amide, or the alkylamine-organic acid complex in the feed stream. The decomposition can occur ~~in~~ when the feed stream and the azeotroping agent are contacted in a fractional distillation apparatus (e.g., column), such as a countercurrent fractional distillation apparatus. The first vapor stream comprises a first azeotrope that comprises the organic acid and the azeotroping agent. Preferably, the majority (e.g., greater than about 50 wt%) of the organic acid of the first azeotrope is a product of thermal decomposition of the organic acid ammonium salt, the organic acid amide, or the alkylamine-organic acid complex in the feed stream. Organic acid in the first azeotrope can also be organic acid that was present in the feed stream prior to heating. Preferably the first azeotrope is a heteroazeotrope. The first vapor stream can be separated producing a first bottoms stream. Preferably, this occurs while vacuum is being applied to the system. When the feed stream comprises at least one impurity, preferably the at least one impurity is at a lower concentration in the first vapor stream than in the feed stream. The first bottoms stream can be present as two phases, it can separate into two phases upon cooling, or it can exist as a single phase.

Please replace the paragraph at page 10 lines 22-29 with the following amended paragraph:

"Enhancer" refers to a chemical species that can be a component of a liquid extractant and that acts to enhance the performance of the ~~alkylamine~~ alkylamine extraction. The enhancer can strengthen the amine:organic acid complex and/or help solubilize the amine:organic acid complex. Use of enhancers in extraction of acids is known in the art. Examples of enhancers that can be used include polar species selected from alcohols, diols, ketones, diketones, fatty acids, chlorinated species, and other species known in the art. Preferably the ratio of the enhancer to the ~~alkylamine~~ alkylamine in the liquid extractant is between about 1:10 and 1:1.

Please replace the paragraph at page 14 lines 27-31 with the following amended paragraph:

Preferred organic amides that can be present in the feed stream in certain embodiments and which can be thermally decomposed to recover organic acid include lactamide, pyruvamide, beta-hydroxy ~~butyamide~~ butyramide, propionamide, and acetamide, among others. The ammonium salts that are present in feed streams of certain embodiments are ammonium salts of the organic acids described above.

Please replace the paragraph at page 18 lines 1-12 with the following amended paragraph:

reactor headspace 4 to condenser 12. Heat can be applied through the use of a reboiler or other using other devices known in the art. Alternatively or in addition to heating the mixture in the reactor 3, at least one of the feed stream 1 or the azeotroping agent 2 can be heated before they are mixed together. The heat is sufficient to cause thermal decomposition of at least one of the organic acid amide, the organic acid ammonium salt or the alkylamine-organic acid complex in the feed stream 1. The heat is also sufficient to vaporize the first azeotrope, but preferably the heat is also not so high as to cause significant degradation or side reaction of the products (e.g. greater than 50 wt% of products degraded or reacted). In certain embodiments a vacuum can be applied to aid in the removal of the vapors from the reactor headspace 4. In certain embodiments, the

reactor 3 can be a countercurrent fractional distillation apparatus, such as countercurrent column.

Please replace the paragraph at page 30 lines 1-12 with the following amended paragraph:

provided by means of a magnetic stirrer/hotplate and a ~~teflon~~ Teflon-coated magnetic stirring bar in the flask. Moderate heating was also provided by the hotplate to compensate for heat loss through the heating mantle. The temperature of the liquid phase (T1) and the vapor phase at the head of the column (T2) was measured by appropriately positioned thermocouples, and was monitored throughout the experiment. A tri-n-octylamine-lactic acid extract was pumped through a stainless steel tube into the column one inch above the packing. A constant feed flow rate of 14.1 g/h was maintained by a metering pump. Before addition of the feed started, a stable n-dodecane vapor flow was established by preheating the system. The liquid condensate collected in this phase of the experiment was separated from the following main fraction, which also contained lactic acid. When the batch charge of n-dodecane was depleted in the flask, a constant n-dodecane feed was also applied.

Please replace the paragraph at page 32 lines 11-20 with the following amended paragraph:

A batch charge of 160 g n-dodecane (213 mL, Fisher Scientific, catalog # 001294) was made to a 250-mL three-neck flask, which was attached to a standard vacuum distillation apparatus via a 1" x 10" column, filled 6" high with Pro-Pak stainless steel dump-packing (Ace Glass, Inc., catalog # 6624-04). A constant vacuum of 22.4 inHg was provided by a membrane pump. A cold trap immersed into an isopropanol/dry ice bath (-78 °C) was inserted between the primary (water-cooled) condenser and the vacuum pump to condense any vapors escaping from the system. Stirring was provided by means of a magnetic stirrer/hotplate and a ~~teflon~~ Teflon-coated stirring bar in the flask. Heating was provided by a 250-mL heating mantle, controlled by an autotransformer. The flask and column were insulated well against heat loss. Moderate heating was also

Please replace the paragraph at page 34 lines 7-26 with the following amended paragraph:

A batch charge of 340 g n-dodecane (453 mL, Acros, lot # B0501185) was made to a 500-mL three-neck flask, which was attached to a standard vacuum distillation apparatus via a 1" x 10" column, filled 8" high with borosilicate glass helices (Aldrich, Inc., catalog # Z41,195-7). A constant vacuum of 23.6 inHg was provided by a membrane pump. A cold trap immersed into an isopropanol/dry ice bath (-78 °C) was inserted between the primary (water-cooled) condenser and the vacuum pump to capture any vapors escaping from the system. Heating was provided by a 500-mL heating mantle, controlled by an autotransformer. The flask and column were well insulated against heat loss. Stirring was provided by means of a magnetic stirrer/hotplate and a teflon Teflon-coated stirring bar in the flask. Moderate heating was also provided by the hotplate to compensate heat loss through the heating mantle. The temperature of the liquid phase (T1) and the vapor phase at the head of the column (T2) was measured by appropriately positioned thermocouples, and was monitored throughout the experiment by a PC. The trilaurylamine-lactic acid complex, containing lauryl lactate enhancer, was fed by a metering pump at a constant flow rate through a stainless ~~steel~~ steel tube into the column, 1" above the packing. It was preheated to 125 °C before entering the column by means of an oil bath. Prior to addition of the feed started, a stable n-dodecane vapor flow was established by preheating the system. The liquid condensate collected in this phase of the experiment was separated from the following main fraction, which also contained lactic acid.

Please replace the paragraph at page 37 lines 7-17 with the following amended paragraph:

A batch charge of 40 g diethylbenzene (46 mL, Acros Organics, lot # A012667201) and tri-n-octylamine-lactic acid complex, prepared separately from 2 mL of 90% commercial L-lactic acid (Pfanstiehl, lot # 22776), 2 mL of water, and 10 mL of tri-n-octylamine (Acros Organics, lot # A010982001), was made to a 100-mL three-neck flask which was attached to a standard vacuum distillation apparatus. The flask contained two liquid phases at this point. Stirring was provided by means of a magnetic

stirrer/hotplate and a ~~teflen~~ Teflon-coated stirring bar in the flask. Heating was provided by a heating mantle, controlled by an autotransformer. The flask and distillation head were insulated well against heat loss. Moderate heating was also provided by the hotplate to compensate heat loss through the heating mantle. The temperature of the liquid phase (T1) and the vapor phase at the distillation head (T2) was measured by appropriately positioned thermocouples.

Please replace the paragraph at page 38 lines 23-31 with the following amended paragraph:

A batch charge of 60 g diethylbenzene (69 mL, Acros Organics, lot # A012667201) and 17 g of aqueous 69% ammonium lactate solution (Pfanstiehl, lot # 26415A) was made to a 100-mL three-neck flask, which was attached to a standard vacuum distillation apparatus. The flask contained two liquid phases at this point. Stirring was provided by means of a magnetic stirrer/hotplate and a ~~teflen~~ Teflon-coated stirring bar in the flask. Heating was provided by a heating mantle, controlled by an autotransformer. The flask and distillation head were insulated well against heat loss. Moderate heating was also provided by the hotplate to compensate heat loss through the heating mantle. The temperature of the liquid phase (T1) and the vapor phase at the distillation head (T2) was measured by appropriately positioned thermocouples.